

WHAT IS CLAIMED IS:

- 1           1.    An infrared imaging apparatus, comprising:  
2                    a dewar, having an internal volume that defines a cold space;  
3                    an IR transmissive window that seals the cold space to receive IR  
4   energy directly from an IR source;  
5                    a first lens located within the cold space to receive IR energy directly  
6   from the IR transmissive window;  
7                    an IR detector located within the cold space in operational  
8   communication with the first lens and positioned coincident to the focal plane of at  
9   least a first and second wavelength of IR energy; and  
10                  an optical stop located within the cold space in front of the single  
11   lens.
- 1           2.    The infrared imaging apparatus of claim 1, wherein the single lens  
2   has a first aspheric profile on a first side and a second aspheric profile on a second  
3   side, the first side parallel to the second side and the second side facing the  
4   detector.
- 1           3.    The infrared imaging apparatus of claim 2, wherein the second  
2   aspheric profile has a holographic optical element.
- 1           4.    The infrared imaging apparatus of claim 3, wherein the holographic  
2   optical element color corrects at least one color band of infrared energy.
- 1           5.    The infrared imaging apparatus of claim 4, wherein the holographic  
2   optical element color corrects a red MWIR band and a blue MWIR band.

1           6.    The infrared imaging apparatus of claim 1, wherein the detector is a  
2    hyperspectral detector.

1           7.    The infrared imaging apparatus of claim 1, wherein the detector  
2    detects at least three wavelengths of IR energy including at least one LWIR band  
3    of energy.

1           8.    The infrared imaging apparatus of claim 1, wherein the LWIR band  
2    of energy is preferably an indigo LWIR band.

1           9.    The infrared imaging apparatus of claim 1, wherein the holographic  
2    optical element coincidently focuses a MWIR band and a LWIR band of IR energy  
3    at a common focal plane.

1           10.   The infrared imaging apparatus of claim 1, wherein the second  
2    wavelength of IR energy is a harmonic component of the first wavelength.

1           11.   The infrared imaging apparatus of claim 1, wherein the single lens is  
2    made of germanium.

1           <sup>12</sup>  
~~13~~.   The infrared imaging apparatus of claim 1, wherein the single lens is  
2    made of silicon.

1           <sup>13</sup>  
~~14~~.   The infrared imaging apparatus of claim 1, wherein the apparatus  
2    performs at an F-stop (F/#) of at least 1.4 with a square field of view of 90x90  
3    degrees.

1 15. The infrared imaging apparatus of claim 1, wherein the detector  
2 concurrently collects radiation from multiple, adjacent spectral radiation bands.

1 16. The infrared imaging apparatus of claim 3, wherein the first aspheric  
2 surface has the following prescription:  
3 radius = -0.94467;  
4 k = 28.345216;  
5 a = -2.13952;  
6 b = -69.5274;  
7 c = 2342.04;  
8 d = -56841.9; and  
9 first surface thickness = 0.548467.

1 17. The infrared imaging apparatus of claim 16, wherein the second  
2 aspheric surface has the following prescription:  
3 radius = -0.61281;  
4 k = 0.1399;  
5 a = 0.033459;  
6 b = -2.3598;  
7 c = 10.889;  
8 d = -36.331; and  
9 second surface thickness = 0.462731.

1 18. The infrared imaging apparatus of claim 17, wherein the holographic  
2 optical element has the following prescription:  
3 -0.0051393, -0.10212, 0.91035, -2.3946.

18  
1 ~~19~~. The infrared imaging apparatus of claim 3, wherein the first aspheric  
2 surface has the following prescription:  
3 radius = -1.23508;  
4 k = 36.049455;  
5 a = -1.69104;  
6 b = -98.6413;  
7 c = 5589.83;  
8 d = -162359; and  
9 first surface thickness = 0.761661.

19  
1 ~~20~~. The infrared imaging apparatus of claim ~~19~~, wherein the second  
2 aspheric surface has the following prescription:  
3 radius = -0.81270;  
4 k = -0.10748;  
5 a = 0.054475;  
6 b = -0.72423;  
7 c = 2.9155;  
8 d = -7.8939; and  
9 second surface thickness = 0.480234.

20  
1 ~~21~~. The infrared imaging apparatus of claim ~~20~~, wherein the holographic  
2 optical element has the following prescription:  
3 -0.017112, -0.038991, 0.55069, -1.6405.